Optimisation of hybrid energy harvesting using finite element method based on vibration excitation

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Abstract

The main objective of this paper is to optimise energy harvesting design of piezoelectric and magnetic based on vibration excitation; an alternate method for predicting the power output of a bimorph cantilever beam using finite element method with harmonic analysis solver. Both power output generated from the electromagnetic and the piezoelectric were combined to form one unit of energy. In addition, the optimum model was analysed using parametric optimisation analysis solver in finite element analysis to produce an optimum power output. The result showed a maximum power output of 56.66 μW from 47.94 Hz, 4.905 m/s^2, and 0.18 cm^3 generated for resonance frequency with acceleration and volume. The decreasing size of the harvester with a low natural frequency produces a high-power output.

Keywords: piezoelectric; electromagnetic; hybrid energy harvesting; finite element analysis; optimisation; vibration excitation; bimorph cantilever beam; response surface optimisation.